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Printing Machine Cleaning Device

The invention concerns a printing machine cleaning device in accordance with the precharacterizing part of claim 1.

The printing machine cleaning device in accordance with the invention primarily serves to introduce water or another cleaning liquid onto rubber blanket cylinders in the printing units of a printing machine. Each printing unit has two rubber blanket cylinders defining a pressure gap through which the strip-shaped or sheet-shaped printing material is passed, with the printing material accepting the printing image from the rubber blanket cylinders. The water or the cleansing liquid is sprayed onto the rubber blanket cylinder at the input side of the printing gap and squeezed into the printing material at the printing gap. The water or the cleansing liquid dissolves ink, residual paper and other soiling from the rubber blanket cylinders and transfers same onto the printing material which transports them away. Instead of transferring the dissolved soiling from the rubber blanket cylinders onto the printing material, a washing cloth can also be provided for which is applied to the rubber blanket cylinders during the washing procedure to strip-off the dissolved soiling. Cleaning devices for printing machines having a washing cloth for washing the rubber blanket cylinders are e.g. known in the art from EP 0299203A2 and W089/01412. In addition, the printing machine cleaning device in accordance with the invention can be utilized for fine dosage moistening of the printing material before it passes

into a dryer subsequent to printing or for moisture conditioning prior to printing, before the printing material passes into the printing unit. A spraying device for spraying the printing material before it enters into a dryer is known in the art from the above mentioned EP 0299203A2 which prevents sudden evaporation of the volatile components of the ink and cleanser or solvent in the dryer to therefore prevent the danger of explosion in the dryer and to distribute evaporation of the volatile components throughout the entire passage time in the dryer.

Additional prior art is disclosed in US-PS 1042812, 2264521, 3545381, DE-PS 1229547, DE 3446608A1, DE 3723400C1, DE 3900657C2 and in patent abstracts of Japan M-946 March 7th, 1990, Vol. 14/No.121 concerning JP 1-317772.

It is the intended purpose of the invention to create a cleaning device for a printing machine with which even very small amounts of liquid can be evenly distributed over a large surface. The cleaning device should be completely automatically controllable in dependence on operation parameters and operation conditions of the printing units and of the entire printing machine. In addition, even while reducing the amount of the liquid to a minimum value, tearing of the printing material on the edges thereof through excessive moisture or dryness and sticking to the printing machine cylinders should be avoided. The cleaning device for the printing machine should thereby be of simple construction and require low maintenance.

This purpose is achieved in accordance with the invention through the characterizing features of claim 1.

Further features of the invention are given in the dependent claims.

The invention is described below with reference to the drawing using a preferred embodiment as an example.

Fig. 1 shows a side view of a printing machine having printing units, a dryer and a cleaning device in accordance with the invention.

Fig. 2 shows a schematic view of the printing machine cleaning device of one of the printing units of figure 1 in the longitudinal direction of the machine.

Each printing machine cleaning device in accordance with the invention in Fig. 1 contains two liquid radiators 2 and 4 in the form of at least one nozzle 2 and 4 for each printing unit 6 and 7 and directly before the entrance 8 to a dryer 9. The nozzles 2 are disposed above a printing material 12 and the nozzles 4 are disposed below the printing material 12, the material being printed in the printing units 6, 7 and subsequently dried in the dryer 9. The volatile components, in particular water and solvents, from the ink and of the cleanser liquid with which the soiled cylinder of the printing unit 6, 7 is cleaned from time to time, evaporate in the dryer 9. The two nozzles 2 and 4 upstream of the entrance 8 to the dryer 9 are directed towards the printing material 12 from both sides and spray water onto the printing material. The water prevents rapid evaporation of the volatile components directly downstream of the input 8 of the entrance 8 into the dryer 9 to distribute evaporation of the volatile components throughout the entire passage time of the

printing material 12 through the dryer 9. The build-up of high concentrations of explosive vapors in the dryer downstream of the entrance 8 is thereby prevented. Sensors 14 and 15 are located in the dryer 9. One of the sensors 14 monitors the temperature and the other sensor 15 the concentration of dangerous vapors and gases in the dryer 9. The sensors 14 and 15 control, in dependence on their measured values, the time duration and quantity of water introduced by the nozzles 2 and 4 upstream of the entrance 8 to the dryer 9. They can also control the introduction of water and cleaning liquid or ink into the printing units 6 and 7. Instead of water, others liquids can also be used which are non-inflammable and non-explosive. All nozzles 2 and 4 are constructed in the same fashion and are controlled automatically in the same manner with regard to their positioning, their dispensing time, and the dispensed quantity of liquid in dependence on the operational parameters and the operational situation of the printing machine, in particular that of the printing units 6, 7 and the dryer 9. Only the nozzles 2 and 4 of the printing unit 7 are therefore described in detail below. This description is applicable respectively to the other nozzles 2 and 4. The printing units 6 and 7, as schematically shown for printing unit 7, have at least one inking unit 20 conventionally disposed on each side of the printing material 12 for introducing the ink onto a plate cylinder 22, a dampening unit 24 for introducing dampening liquid onto the plate cylinder 22, and a printing cylinder 26, normally a rubber blanket cylinder, for transfer of the printing image from the plate cylinder 22 onto the printing material 12. The printing material 12 travels in a S-shaped fashion through a printing gap between the two neighboring rubber blanket cylinders 26 above and below the printing material 12.

Figure 2 shows the printing machine cleaning device of printing unit 7 viewed, with respect to figure 1, from the left towards the right in the longitudinal direction of the machine and having the nozzle 2 disposed above the printing material 12 and the nozzle 4 disposed below the printing material 12. The nozzles 2 and 4 are, relative to figure 1, each pivoted by approximately 90° in an upward and downward direction respectfully in the representation of figure 2 so that the details can be more clearly seen. The upper nozzle 2 can be moved by upper movement device 28 and the lower nozzle 4 can be moved by an identically constructed lower movement device transverse to the longitudinal direction of motion 34 of the printing material 12 transported through the printing machine in an automatically controlled fashion across the entire width or over a partial width of the printing material 12 or of the rubber blanket cylinder 26 to spray liquid 34 onto the associated rubber blanket cylinder 26. It is also possible to automatically control continuous movement of the nozzles 2 and 4 to arbitrary position along the width of the printing material 12 or of the rubber blanket cylinder 26 and to only spray fluid 32 onto the printing material 12 or onto the rubber blanket cylinder 26 at a desired position. In figure 2, the nozzles 2 and 4 spray liquid 32 onto the rubber blanket cylinder 26 along a width which is, in correspondence with the transverse motional path of the nozzle, wider than the width 36 of the liquid atomizing cone 32 of these nozzles 2 and 4 at the rubber blanket cylinder 26. In the preferred embodiment shown, the transverse path length 38 is as large as the width of the rubber blanket cylinder 26 minus the width 36 of the liquid atomizing cone 32 at the rubber blanket cylinder 26 (see figure 2). In this manner, the rubber blanket cylinder 26 is moistened with fluid from the

atomizing cone 32 along its entire width with one single transverse displacement of the nozzle 2 or 4 through the transverse path length 38. The nozzle 2 is thereby moved from the right position in figure 2, drawn with solid lines, into the left position of figure 2, indicated with dashed lines 2/2. The nozzle 2 can remain stationary in the second position 2/2. If the rubber blanket cylinder 26 is to be moistened again at a later point in time, the nozzle 2 is moved back from the left position 2/2 into the right position, indicated with solid lines, wherein liquid is then sprayed in correspondence with the atomizing cone 32 onto the rubber blanket cylinder 26 during this transverse motion. In the embodiment shown, the nozzle 4 of the lower rubber blanket cylinder 6 moves, oppositely to the upper nozzle 2, from left to right and subsequent thereto likewise oppositely to the upper nozzle 2 from the right towards the left. The lower nozzle 4 is thereby located in the right position 4/2 shown with dashed lines when the upper nozzle 2 is located in its left position 2/2 indicated with dashed lines and vice versa. This has the advantage that both side edges of the printing material 12 are immediately and evenly simultaneously moistened with liquid from both nozzles 2 and 4 transferred by means of the rubber blanket cylinders 26 to avoid a sticking of the side edges to the rubber blanket cylinders 26 and a tearing of these side edges of the printing material. During the cleaning procedure in which liquid 32 is sprayed from the nozzles 2 and 4 onto the rubber blanket cylinder 26, the introduction of ink from the inking units 20 is normally switched off. The nozzles 2 and 4 are configured in such a fashion that they form as wide an atomizing cone 32 as possible. The wider the atomizing cone 32, the shorter the required transverse path length 38. The devices 28 and 30 for moving the nozzles 2 or 4 can be

pneumatic, hydraulic or electrical drive units. The residual ink, paper fibers and other impurities on the rubber blanket cylinders 26 dissolved or loosened by the liquid from the nozzles 2 and 4 are transferred onto the printing material 12 at the printing gap between the two neighboring rubber blanket cylinders 26 and transported away thereby. Instead of transferring the soiling onto the printing material 12, a washing crosspiece 40 or 42 can be disposed opposite each rubber blanket cylinder 26 for applying a washing cloth 43 or 44 to the opposing rubber blanket cylinder 26 to strip the residual ink and soiling particles dissolved or loosened by the liquid from the nozzles 2 and 4 from the rubber blanket cylinder. Such washing crosspieces, each having a washing cloth, are known in the art from EP 0299203A2.

The length of the transverse motional path 38 depends on whether or not the nozzles 2 or 4 are to be moved across the entire width of the rubber blanket cylinder 26 or only along a portion thereof. This normally depends on the width of the printing material 12 or on which section of the width of the printing material is to be printed, or on which width positions of the rubber blanket cylinder 26 are to be moistened by liquid from the nozzles 2 and/or 4 in a point-like fashion, in linear fashion or over an area. Although a plurality of nozzles 2 and a plurality of nozzles 4 can be utilized in each case, the embodiment shown in figure 2 is preferred with which only one nozzle 2 or 4 is provided for each rubber blanket cylinder 26. A small amount of liquid can be distributed across a large surface using one single nozzle in a more precise fashion with regard to time and amount and more evenly than with a plurality of nozzles.

An automatic dosing device doses, in each case, a certain amount of liquid sprayed by the nozzles 2 and 4 onto the associated rubber blanket cylinder 26 during their sideward motion across the transverse path length or at a particular transverse position: for the case of the nozzles 2 and 4 of the dryer 9, onto the printing material 12. This automatic dosing device has an individual storage conduit 50 for each nozzle 2 and 4 to store the dosed amount of liquid. The storage conduit 50 is flow-connected to the associated nozzle 2 or 4 at its downstream end and at its upstream end via a branch 51, to two valves 52 and 54. When valve 52 is opened and valve 54 closed, the storage conduit 50 is filled with liquid, the amount of which depends on the inlet pressure of the liquid and the opening time of the valve 52. These two parameters "time" and "inlet pressure of the liquid" can be fixed predetermined quantities or, preferentially, be automatically controlled by an electronic control device 56 and optionally influenced in dependence on other parameters of the printing machine. After dosing of the liquid in the storage conduit 50, all valves 52 and 54 are once more closed. In the event of a malfunction downstream of the valve, only that liquid which is dosed into the storage conduit 50 can escape. In order to spray the dosed amount of liquid, one of the valves 52 is closed and the corresponding other valve 54 opened and the dosed amount of liquid is driven by compressed air out of the storage conduit 50 and out of the associated nozzle and sprayed along the atomizing cone 32. The valve 52 for the liquid and the valve 54 for the compressed air are controlled in time by the electronic control device 56 in such a fashion that the nozzles 2 and 4 only spray liquid during the period of time during which the nozzles 2 and 4 should moisten the rubber blanket cylinder 26 or the printing material 12 and are thereby moved

transversely over these objects during the spraying process. The pressure of the compressed air and the flow resistance in the conduits are dimensioned in such a fashion that the dosed amount of liquid is distributed evenly during the transverse motion of the nozzles 2 and 4 along their paths 36 and 38. The opening and closing of the valves 52 and 54 is effected by the control device 56 in dependence on parameters and operational conditions of the printing machine. Such parameters are e.g. interruption times for washing the rubber blanket cylinders, the type and amount of ink used, the width of the printing material 12 and the like. The compressed air valves 54 are connected to a compressed air source 59 via a pressure regulator 58. The liquid valves 52 are connected to a liquid source 60. The liquid introduced from the liquid source 60 to the liquid valves 52 can be water, solvent, another kind of cleaning liquid or a mixture of a plurality of such components. The liquid source 60 preferentially has means for selective dispensing of water alone or for the dispensing of other cleansing liquids or for a mixing of water from a water container 61 and a cleanser from a cleanser container 62. This mixing and introduction of liquids from the liquid source 60 can also be controlled and regulated over time and in respect to quantity by means of the control device 56. The control device 56 preferentially contains a plurality of operational programs which carry out the above mentioned control processes in dependence on desired values.

The nozzles 2 and 4 of the one printing unit 6 and the nozzles 2 and 4 at the entrance 8 of the dryer 9 can each also be connected to the liquid source 60 and compressed air source 59 via a storage conduit 50 and selectively to liquid valves 52 and compressed air valve 54. The movement devices

28 and 30 for the nozzles 2 and 4 are likewise controlled by the control device 56. In this fashion, a matching of liquid application to the transverse motion of the nozzles 2 and 4 and to other parameters and operating conditions of the printing machine is achieved. Figure 2 schematically shows connectors 64 on the control device 56 for the valves 52, connectors 65 for the valves 54 and connectors 66 for controlling the movement devices 28 and 30.

The liquid conduits consist, at least partially, of flexible tubes in order to facilitate movement of the nozzles 2 and 4 relative to the stationary components.

Each nozzle 2 or 4 moves during a very short period of time, preferentially of less than one second, transverse to the longitudinal direction of the machine and across that region of the rubber blanket cylinder 26 or of the printing material 12 which is to be moistened. This amount of time is sufficient for even spraying and distributing of the dosed amount of liquid along the entire transverse path 36 and 38. A substantial advantage of the invention is that, due to utilization of only a very small number and preferentially of only one nozzle for each surface to be moistened, even very small amounts of liquid can be distributed evenly over a large surface of the machine cylinder or of the printing material. The precision of dosing is improved to a greater extent if the liquid is dosed in a storage conduit 50 in accordance with the above mentioned embodiment, with only the associated dosed amount of liquid then being sprayed. This liquid dosing has the additional advantage that, in the event of machine malfunction, only the dosed amount of liquid can run out of the conduit and not a larger amount from the liquid container. The invention has the additional advantage

that the danger of a subsequent dripping of liquid, following the spraying procedure, onto the rubber blanket cylinder or the printing material out of the individual nozzle 2 or 4 is reduced and, when utilizing a storage conduit 50 with subsequent compressed air cleaning, is nearly completely eliminated.

Instead of a nozzle 2 or 4, liquid radiators 2 or 4 can be utilized each having one or a plurality of nozzles. Other types of liquid radiators can also be used.

The liquid which is sprayed by the radiators 2 and 4 onto the printing cylinder 26 is a cleaning liquid such as e.g. water, solvent, cleansing agent or a mixture thereof. The liquid is suitable for cleaning the printing cylinder 26.

DE 3723400C1 discloses a technique for washing the rubber blanket of a rotary offset printing machine in connection with a particular process concerning the heat setting dryer. The sheet brings the solvent rolled off from the rubber blanket cylinder at the printing position into the dryer. In this process, high concentrations of ignitable vapors can occur with an associated danger of explosion. The production of solvent vapor depends on the amount of input solvent agent itself corresponding to the amount of solvent agent utilized for washing, the temperature dependence, and also on additional transport parameters of the transported paper sheet and is controlled by material applied to the surface of the sheet which removes warmth and which seats on the surface of the sheet. The loading of the dryer with solvent vapors as a result of the washing process in the printing unit during continuous passage of the sheet is well known in the art.

A well known problem associated with the washing of rubber blankets with a running sheet, is the tearing of the sheet since, in addition to sticking effects occurring during a continuous printing run of the sheet at the output gap of the rubber blanket cylinder, non-characteristic sudden contact forces and similar ones associated with fluctuations in the sheet tension during washing the rubber blanket can occur. To counteract this effect, processes are known in the art with which a wetting of the sheet using a separation liquid is overlapped with the critical phases of rubber blanket washing (DE 39065701).

In contrast to the conventional applications, one would like to eliminate soiling on the cylinders and rollers using as small an amount of solvent as possible, in view of the solvent content in the printing room or in the dryer, while thereby simultaneously minimizing the probability of tearing the sheet.

This purpose is solved by the processing features and the structural features in the device described herein.

In contrast to a spraying configuration having a plurality of nozzles within a nozzle crosspiece which extends across the width of the cylinder, the spraying from one or from a low number of nozzles, preferentially two, is easier to control since, already with regard to the number of occurrences, malfunctions are easier to control using suitable techniques. Start-up and maintenance are simplified. Difficulties and expense associated with a plurality of nozzles are correspondingly limited in a proportional manner with one or two nozzles so that the difficulty and expense for regulation is also acceptable from an economical point of view. In high

quality applications, the actual values with respect to the nozzle geometry and the amount of spray are recorded to control activators to optimize the operation.

It is advantageous to address accumulation of ink at the edges of the continuous paper sheet or of the paper sheets in the printing direction separately from the other cleaning processes concerning the overall width and to direct spraying amounts locally and sideward towards the edges, since locations having a low degree of soiling caused by ink and paper dust accumulation do not require the same kind of processing.

It is also advantageous to separate out critical locations which occur e.g. through repeated positions for cleaning on the printing plate. Associated neighboring clean areas or areas of low soiling are avoided or processed differently.

With the proposed method and device in accordance with the invention, a flexible cleaning process is provided which can be programmed using the fuzzy logic principle, wherein relatively bulky and unchangeable components of a washing program can be replaced by a user friendly, flexible instruction system which nevertheless leads to complete cleaning.

In addition, the local application of cleaning fluid can be utilized preventively to oppose occurrence of accumulated soiling. Towards this end, the directed use of portioned cleaning fluid can be dosed in such a fashion that no noticeable waste paper occurs during the production run, with the maintenance processes nevertheless guaranteeing a long and stable printing run. Such a partial cleaning program is

either controlled in a stochastic manner or the spraying is directed to selected distribution only at those locations where there is a strong tendency for accumulation or for frequent cleaning.

Locally adapted cleaning is substantially directed to the edges of the printing material, to chosen regions associated with the guiding ink zones, and to areas or spots localized sideward and in the direction of printing. With prolonged loading of an axially disposed section of a partial width of the roller or of the cylinder, the cleaning zones image in the form of strips. Should the cleaning head move, the strips are no longer parallel to the printing direction. Due to the sideward displacement, they extend at an angle with respect to the printing direction e.g. in the shape of a slanted helix.

For brief applications, the conceptual strips are shortened and imaging of the moved cleaning surface occurs along a limited surface as seen in the unfolding direction or at a section of a surface which can be ideally represented as rectangular.

Individually matched cleaning over a wide surface can advantageously be adapted to the conditions of the printing procedure. The accumulation of ink at the edges of the printing material is strip-shaped so that it should be counteracted accordingly with strip-shaped cleaning. Ink zones having high ink coverage and tending towards ink accumulation can occur for a certain color or for superimposed printing and are likewise suitably handled in a strip-shaped fashion. Individual locations of the printed

image which can be reproduced as surfaces having certain coordinates are only treated as surface sections.

An overall cleaning across the entire width of the cylinder is effected by combining the treatment surfaces, wherein the liquid radiators travel throughout the entire width of the cylinder to cover the entire outer surface of the roller or cylinder. Axial advancement leads to a helical-shaped or strip-shaped coverage. In dependence on the dynamics of the movement of the radiator, the radiator can also be rapidly displaced sideward into the next position so that the cleaning pattern on the cylindrical surface of the printing unit cylinder can be covered by individual sequential rings. Action over a broad surface effects coverage of the outer surface in patches, such as in a chess board. When the radiator is moved axially, the most rapid cleaning has the largest helical pitch and advancement of the radiator by one active width is effected after completion of one roller or cylinder revolution. With slow advancement, the active widths overlap each other a plurality of times to effect more intense cleaning action with, however, the cleaning time being increased. The pitch of the processing strip is smaller and analogous to a pitch of a thread.

In order to reduce the cleaning time, the cleaning surface can be covered using not one but a plurality of radiators 2 and 4. A first radiator 2 is preferentially disposed at the left and a second radiator 4 at the right edge of the printing material. This configuration has the advantage that displacement can be aligned symmetrically relative to the middle of the printing material. For a continuous sheet, this configuration thereby compensates for the asymmetric dependence of the sheet tensioning processes.

First printing and second printing using a continuous sheet machine causes soiling of both oppositely disposed printing cylinders 26. In a double printing unit, the radiators 2 and 4 are introduced at initial positions diagonal with respect to the sheet: e.g. one radiator 2 for the upper printing unit moves from the left and the other radiator 4 for the lower printing unit moves from the right.

The liquid transferred to the printing material imparts, for its part, a symmetric pattern when the first printing and second printing side are viewed together. One can thereby prevent the sheet, which only absorbs cleaning fluid to a limited extent, from simultaneously coming into contact with the cleaning fluid from above and from below in one region.

In a rotary printing machine, the strip-shaped or wide area coverage of the outer surface of the roller or cylinder to be cleaned has the decisive advantage that the amount of explosive solvent entering into the dryer along with the sheet can be kept to a low value. The danger of explosion, which can be monitored by means of concentration or temperature sensors, is substantially reduced.

The wiper motion in a printing unit causes the cleaning liquid applied at an axial region to be sideward displaced when travelling over the inking unit. Utilization of a radiator 2, 4 imparting cleaning tracks facilitates synchronization of the track to the wiper. If e.g. cleaning liquid is for cleaning purposes e.g. at a particular ink zone on the rubber blanket cylinder, selectively introduced however in an indirect rather than direct manner with the radiator spraying the cleaning fluid onto a inking roller

upstream of the rubber blanket cylinder, the phase position of the one or of the plurality of wipers along the path to the rubber blanket cylinder can be taken into consideration in such a fashion that the cleaning fluid reaches the rubber blanket cylinder at the targeted location.

In order to effect removal of accumulated ink by the printing material outside of the edges of the printing material, one takes advantage of the motion of the wiper. When the wiper travels to its outer dead point, a stripping element is introduced in the peripheral direction onto the wiper or onto a downstream roller in order to prevent the liquefied soiling from outwardly dispersing. When the wiper moves in the inward direction, the stripping element is lifted so that the inwardly traveling soiling travels without hindrance inwardly towards the paper and can be transported away.